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Original article

Predictive factors for patients discharged after participating in a post-acute care program

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ABSTRACT

Purpose: This prospective study aims to determine predictive factors for patients to be discharged to home after receiving post-acute care (PAC) services and to improve the case-finding criteria for PAC services in Taiwan.
Methods: Elder patients admitted to Taichung Veterans General Hospital for treatment of an acute illness were assessed by simplified comprehensive geriatric assessment (CGA) and clinical evaluation. Patients with functional recovery potential were transferred to community hospitals for further PAC service. Discharging status from a PAC unit to a home or long-term care facility was recorded.
Results: From January 2009 to September 2010, 123 patients were recruited. 40 patients didn't receive complete PAC service and the remaining 83 patients completed the program. Among the 83 patients that completed the program, 56 patients (67.5%) were discharged to home and 27 patients (32.5%) were transferred to long-term care facilities. The Barthel index (BI) before receiving PAC was low (35.0 ± 21.34) and all patients had below average nutrition. Using multiple logistic regression analysis, patients receiving prior orthopedic surgery, living with other people and in a malnourished state were more likely to be discharged to home after receiving PAC service.
Conclusion: Two-thirds of PAC patients can be safely discharged to home after receiving PAC services. Patients who live with other people, have prior orthopedic surgeries, and have good nutritional status represented predictive factors for returning home safely.

1. Introduction

Population aging is a global phenomenon that affects both developed and developing countries. An escalating elderly population can result in various challenges to health care systems, especially in the area of hospital admission demands.[1] Elderly patients typically require longer hospital stays as well as post-acute care (PAC) services to promote restoration of physical function following acute illnesses. Comprehensive geriatric assessment (CGA) intervention programs have been shown to successfully reduce hospital readmissions and functional decline after acute illnesses of the elderly.[2–4] Therefore, a CGA-based intervention of PAC programs is of great importance for improving long-term outcomes of acute care as well as increasing efficiency of the health-care system.[5]

In England, intermediate care, which is interchangeable with PAC, was introduced in 2000 and became a national policy. The goals of intermediate care included hospital readmission avoidance, premature long-term care placement prevention, and physical independence promotion for frail older patients.[6] The effectiveness of PAC programs to reduce hospital readmission and to improve physical independence has been well established.[5,7] In Taiwan, the first community hospital-based PAC program started in 2006[8] and significantly improved physical function, mental function, and management of pain. However, despite extensive efforts some patients fail to restore their functional independence and need to be transferred to long-term care facilities. Several risk

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factors related to the failure of functional recovery in PAC programs have been reported, they include; urine incontinence, poor cognitive function, and poor social support.[9] Therefore, the main purpose of this study was to identify predictive factors for patients receiving PAC services to be discharged home with the intent to improve the case-finding criteria for PAC services in Taiwan.

2. Materials and methods

2.1. Participants and program

Patients aged 65 years and over admitted to Taichung Veterans General Hospital (a tertiary medical center in middle Taiwan) were evaluated for PAC needs by trained case managers by simplified CGA if they met the inclusion/non-inclusion criteria. The inclusion criteria for PAC services were: (1) age older than 65; (2) medically stable, requiring no intensive medical, laboratory or oxygen support; and (3) presence of acute functional decline during hospitalizations. Non-inclusion criteria included: (1) admission for elective procedures; (2) acute conditions related to terminal illness; (3) malignancy; (4) severe dementia; and (5) patients who were considered to have a low potential for functional recovery.[10] After evaluation by the abovementioned criteria, patients were transferred to two affiliated community hospitals, Puli Veterans Hospital and Chiayi Veterans Hospital, for PAC services if it was determined that they had a potential for functional recovery.

An interdisciplinary team was established to provide PAC services in the patient's PAC units. The arrangement of the PAC intervention program is based on the results of CGA and discharge possibility of the patient is assessed every other week. The PAC program typically lasts 4 weeks or less and may be extended for up to 12 weeks if the patient is considered able to recover by the interdisciplinary team. On the contrary, patients may be transferred to long-term care facilities if they did not recover sufficiently after all options were exhausted.

2.2. Comprehensive geriatric assessment

Demographic characteristics and past medical histories were recorded by the case manager. The case manager in the medical center performed simplified CGA, which includes Barthel Index (BI),[11] Lawton-Brody instrumental activities of daily living scale (IADL),[12] Morse fall scale,[13] Geriatric Depression Scale short form (GDS-5),[14,15] and Mini Nutritional Assessment short-form (MNA-SF).[16] The entire program was approved by the Ethics Committee of Taichung Veterans General Hospital and written informed consent was obtained from each participant.

2.3. Statistical analysis

Continuous variables were expressed as mean ± standard deviation and categorical data expressed as percentages. Comparisons between continuous variables were done using the student *t* or Mann-Whiney test, and comparisons between categorical data were done using the chi-square or Fisher's exact test when appropriate. Multiple logistic regression analysis was used to identify independent predictive factors for returning home. All statistical analyses were performed using commercial software (SPSS 12.0 for Mac, SPSS Inc, Chicago, IL). For all tests, $p < 0.05$ was considered statistically significant.

3. Results

From January 2009 to September 2010, 123 patients participated in the PAC program of Taichung Veterans General Hospital after careful evaluation of inclusion/non-inclusion criteria. Among the patients, 40 (32.5%) were excluded for further analysis due to unplanned readmission or other factors causing incomplete PAC services. The main cause of incomplete PAC service was unstable medical conditions like fever, upper gastrointestinal bleeding and dyspnea. The remaining 83 patients (80.3±8.6 years, 96.4% males) completed PAC services with the mean PAC stay of 32.5 (±16.2) days. Of these patients, 49 patients were admitted to the Internal Medicine department. There were 24 patients receiving orthopedic surgeries, of which 22 were for hip fracture while the other 2 were for spinal stenosis and fibular fracture. Finally, two-thirds (56/83, 67.5%) of the patients successfully returned home and 27 patients (32.5%) were transferred to long-term care facilities due to insufficient functional recovery or social support.

Table 1 shows the demographic characteristics of patients who completed PAC services. Compared to other etiologies, patients receiving PAC services due to prior orthopedic surgeries are more likely to return home (37.5% *vs.* 11.1%, p = 0.026). Moreover, patients that live alone tend to be transferred to long-term care facilities more often than those who live with other people (59.3% *vs.* 33.9%, p = 0.051). Table 2 showed comparisons of simplified CGA results before and after acute illness. The mean Barthel Index (BI) before acute illness was 83.9 (±18.2) while the mean BI after acute illness was 31.5 (±21.3). A marked drop in BI and IADL after acute illness was noted in both groups but there was no difference in the change value between these two groups. All patients were malnourished, and patients with a higher baseline MNA-SF score are more likely to return home (6.6 ±1.9 *vs.* 5.6 ±2.3, p = 0.047). The Chinese version Mini-mental state exam (MMSE)[17,18] after being admitted to PAC was 17.6 (±6.1) in patients discharged to home and 15.3 (±5.7) in patents discharged to long-term care facilities. There was no significant difference between these two groups. Multiple logistic regression analysis showed that prior orthopedic surgeries, living with others, and better baseline nutritional status were significant independent predictive factors for safely returning home (Table 3).

Table 1
Demographic and clinical characteristics of all the patients discharged to home and to long-term care facilities

	Home (n = 56)	Long-term care facilities (n = 27)	*p* value
Age (y)*	81.1 (±8.3)	78.4 (±8.9)	NS
Gender (male)*	54 (96.4)	26 (96.3)	NS
Living status (alone)*	19 (33.9%)	16 (59.3%)	0.051
Orthopedic surgery during hospitalization*	21 (37.5%)	3 (11.1%)	0.026

NS = non-significance.
* Data reported as mean (±SD) or number (%).

Table 2
Simplified CGA score before admission to PAC unit for patients discharged to home and to long-term care facilities

	Home (n = 56)	Long-term care facilities (n = 27)	*p* value
BI (before admission)*	82.6 (±19.8)	86.7 (±24.2)	NS
BI (after acute illness)*	35.5 (±21.3)	33.9 (±21.7)	NS
IADL (before admission)*	5.1 (±2.6)	5.2 (±2.5)	NS
IADL (after acute illness)*	2.1 (±2.1)	1.7 (±1.7)	NS
Morse fall scale*	74.2 (±20.0)	66.6 (±24.2)	NS
GDS-5*	1.9 (±1.2)	1.6 (±1.7)	NS
MNA-SF*	6.6 (±1.9)	5.6 (±2.3)	0.047

BI = Barthel Index; IADL = Lawton-Brody instrumental activities of daily living scale; NS = non-significance.
* Data reported as mean (±SD).

Table 3
Multiple logistic regression analysis to determine predictive factors for patients discharged to home or long-term care facilities after PAC program

	Adjusted OR	95% CI	*p* value
Orthopedic surgery during hospitalization*	5.088	1.288–20.097	0.020
Living status (alone)*	0.341	0.122–0.949	0.039
MNA-SF*	1.291	1.002–1.662	0.048

MNA-SF = Mini Nutritional Assessment short-form; OR = Odds Ratio.
* Variables entered in the step 1 for multiple logistic regression included MNA-SF, orthopedic surgery during hospitalization and living status.

4. Discussion

In this study, 67.5% of the patients receiving PAC services can regain their function and return home but 32.5% of patients need long-term care placement despite receiving interdisciplinary PAC services. Patients who lived with other people, received prior orthopedic surgeries, and had good nutritional status were independent predictive factors for successful returning home. It has been reported that solitary living or unmarried older people are more likely to be institutionalized due to age, cognitive function, and baseline physical function.[9,19,20] In the Chinese population, older age and marital status were also independent predictive factors for institutionalization.[21] Despite significant functional recovery as a result of PAC services, patients typically did not regain complete functional independence. Therefore, family and other care resources will play an important role in supporting and improving physical function after returning home. Elder people living alone usually have less social support and lower economic income which may increase the difficulties of living at home, even after the PAC program had significantly improved their physical function. Moreover, patients may lack strong motivation for participating in continuing rehabilitation therapy after the PAC program.

The benefits of PAC services for patients who have received prior orthopedic surgeries are controversial.[20,21] which may be a result of differences in rehabilitation programs, intensity and patients groups. The majority of our patients received orthopedic surgeries for hip fracture. PAC programs may reduce hospital lengths of stay, complications, and improve physical function for patients receiving orthopedic surgeries,[22–24] but these phenomena are not universally supported.[25–29] Nevertheless, in recent years more patients receiving orthopedic surgeries were transferred to other settings like inpatient rehabilitation units or PAC units for step-down care.[30] Del Giudice et al reported that physical function recovery was better in surgical patients than in medical patients during PAC services and that surgical patients were more likely to return home.[31] Surgical patients are usually evaluated for medical conditions before surgery and they usually have fewer medical comorbidities. Therefore, it is likely that these patients would recover better from disease episodes.

Malnutrition has been associated with poorer clinical outcomes with various diseases.[32–35] Severe nutritional impairment was an independent risk factor for acute patients to be admitted to nursing home,[36] and lower serum albumin level was also an independent risk factor for PAC patients to be institutionalized.[9] In this study, patients with better baseline nutritional status were more likely to return home which is compatible with previous reports. However, the high prevalence of malnutrition deserves more intensive nutritional intervention to support functional recovery for all patients.

In a study by Luk et al, 21.7% of older patients admitted to geriatric units for PAC services were placed in nursing homes afterwards.[9] They reported that patients with unmarried or widowed status, as well as persistent urinary incontinence during PAC services, were more likely to be transferred to long-term care facilities. In our study, the higher long-term care facility placement rate that we observed may be associated with a poorer functional status at admission to the PAC unit (BI: 35.0 ±21.3) than the study from Hong Kong (BI: 70.8 ±22.4) since poorer functional status is a major predictor for institutionalization.[9] These results suggest that the selection criteria in tertiary medical centers should be modified to prioritize patients with higher physical function for PAC services. However, the optimal cut-off of physical function remains unclear and the result of PAC services for each patient is individualized. Nevertheless, a modified screening protocol from acute hospitals may improve the success of the PAC program.

As high as 32.5% of the enrolled patients did not complete the PAC service which may be considered a poor quality indicator for acute care. The main causes of immediate re-admissions include fever, upper gastrointestinal tract bleeding, and dyspnea. Some patients left the PAC service due to unexpected environments in the PAC units or economic issues. The unplanned intermediate readmission rates were 18.6% in the Lee et al study[8] and 8.1% in the Luk et al study.[9] The reasons for the increased intermediate readmission rate may be attributed to immature patient selection criteria and poor physical function. The rate of generating an unstable medical condition was higher in patients with poor physical function. The mean BI in the Lee et al study was 47.1 (±33.6) and 70.8 (±22.4) in Luk et al study, which were higher than our BI of 35.0 (±21.3). In addition, patients from the Internal Medicine department typically had more medical comorbidities than surgical patients which might increase the rate of unplanned re-admission.[31] In our study, around 60% of patients were admitted for medical conditions and a higher readmission rate could be expected. However, we wish to improve the case-finding process because these medical conditions are highly correlated to poorer functional status.

There were some limitations in our study. First, the determination of rehabilitation potential was inexplicit and was dependent on the decision of case managers and the nursing station staff of the acute wards. Therefore, the perceptions of rehabilitation needs may vary between case managers, nursing staff and the interdisciplinary team of the PAC units. Second, there was no objective evaluation tool for patient cognition in our simplified CGA. The Chinese version MMSE would be checked when patients were admitted to PAC units.[17,18] According to the detailed CGA from veteran hospitals, there was no significant difference in MMSE (17.6 ±6.1 *vs.* 15.3 ±5.7). Third, small sample size may limit our ability to extrapolate the study results to the general population. However, the results are still of critical importance for other PAC programs to be developed in Taiwan.

In conclusion, two-thirds of PAC patients may successfully return home after receiving PAC services. Patients who live with others, have had prior orthopedic surgeries, and have a good nutritional status are significant predictive factors for safely returning home after receiving PAC services.

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